

**CLAIMS**

1. A catalyst composition comprising:
  - (a) a support;
  - (d) a first metal component comprising rhodium; and
  - (e) a second metal component comprising a metal other than rhodium and selected from Groups 1 to 15 of the Periodic Table of Elements,wherein said first and second components are predominantly contained in an outer surface layer of the support having a depth of not more than 1000 microns.
2. The catalyst composition of claim 1 wherein the depth of said outer surface layer of the support is not more than 500 microns.
3. The catalyst composition of claim 1 wherein the depth of said outer surface layer of the support is not more than 300 microns.
4. The catalyst composition of claim 1 wherein the depth of said outer surface layer of the support is not more than 100 microns.
5. The catalyst composition of claim 1 and comprising from about 0.01% to about 10% of rhodium by weight of the total catalyst composition including the support.
6. The catalyst composition of claim 1 and comprising from about 0.1% to about 3.0% of rhodium by weight of the total catalyst composition including the support.
7. The catalyst composition of claim 1 and comprising from about 0.01% to about 20 % by weight of the metal of the second metal component by weight of the total catalyst composition including the support.

8. The catalyst composition of claim 1 and comprising from about 0.4% to about 5 % by weight of the metal of the second metal component by weight of the total catalyst composition including the support.

9. The catalyst composition of claim 1 wherein said second metal component comprises a metal selected from Group 13 of the Periodic Table of Elements.

10. The catalyst composition of claim 1 wherein said second metal component comprises indium.

11. The catalyst composition of claim 10 and comprising from about 0.01% to about 20% of indium by weight of the total catalyst composition including the support.

12. The catalyst composition of claim 10 and comprising from about 0.4% to about 5.0% of indium by weight of the total catalyst composition including the support.

13. A catalyst composition comprising:

- (a) a support;
- (b) a first metal component comprising rhodium;
- (d) a second metal component comprising a metal selected from Groups 12 to 15 of the Periodic Table of Elements; and
- (e) a third metal component comprising a metal different from those of said first and second components and selected from Groups 1 to 15 of the Periodic Table of Elements.

wherein at least said first and second metal components are predominantly contained in an outer surface layer of the support having a depth of not more than 1000 microns.

14. The catalyst composition of claim 13 wherein the depth of said outer surface layer of the support is not more than 500 microns.

15. The catalyst composition of claim 13 wherein the depth of said outer surface layer of the support is not more than 300 microns.
16. The catalyst composition of claim 13 wherein the depth of said outer surface layer of the support is not more than 100 microns.
17. The catalyst composition of claim 13 wherein said third metal component is also contained in said outer surface layer of the support.
18. The catalyst composition of claim 13 and comprising from about 0.01% to about 10% of rhodium by weight of the total catalyst composition including the support.
19. The catalyst composition of claim 13 and comprising from about 0.04% to about 5% of rhodium by weight of the total catalyst composition including the support.
20. The catalyst composition of claim 13 and comprising from about 0.01 wt% to about 30 wt% of the metal of the second metal component by weight of the total catalyst composition including the support.
21. The catalyst composition of claim 13 and comprising from about 0.04 wt% to about 20 wt% of the metal of the second metal component by weight of the total catalyst composition including the support.
22. The catalyst composition of claim 13 wherein said second metal component comprises a metal selected from Group 13 of the Periodic Table of Elements.
23. The catalyst composition of claim 13 wherein said second metal component comprises indium.

24. The catalyst composition of claim 13 and comprising from about 0.01% to about 20% of indium by weight of the total catalyst composition including the support.

25. The catalyst composition of claim 13 and comprising from about 0.04% to about 10% of indium by weight of the total catalyst composition including the support.

26. The catalyst composition of claim 13 and comprising from about 0.01% to about 50% of the metal of the third metal component by weight of the total catalyst composition including the support.

27. The catalyst composition of claim 13 and comprising from about 0.05% to about 30% of the metal of the third metal component by weight of the total catalyst composition including the support.

28. The catalyst composition of claim 13 wherein said third component comprises at least one metal selected from Groups 8 to 10 of the Periodic Table of Elements.

29. The catalyst composition of claim 13 wherein said third component is selected from one or more of iron, ruthenium and cobalt.

30. The catalyst composition of claim 29 wherein the third component is iron and the catalyst composition comprises from about 0.05% to about 30% of iron by weight of the total catalyst composition including the support.

31. The catalyst composition of claim 29 wherein the third component is iron and the catalyst composition comprises from about 0.1% to about 20% of iron by weight of the total catalyst composition including the support.

32. The catalyst composition of claim 29 wherein the third component is cobalt and the catalyst composition comprises from about 0.05% to about 30% of cobalt by weight of the total catalyst composition including the support.

33. The catalyst composition of claim 29 wherein the third component is cobalt and the catalyst composition comprises from about 0.1% to about 25% of cobalt by weight of the total catalyst composition including the support.

34. The catalyst composition of claim 29 wherein the third component is ruthenium and the catalyst composition comprises from about 0.05% to about 10% of ruthenium metal by weight of the total catalyst composition including the support.

35. The catalyst composition of claim 29 wherein the third component is ruthenium and the catalyst composition comprises from about 0.1% to about 5% of ruthenium metal by weight of the total catalyst composition including the support.

36. A method of making a catalyst composition, the method comprising:

- (a) applying a rhodium compound to a surface layer of a support having a depth of not more than 1000 microns;
- (b) applying a compound of a second metal selected from Groups 12 to 15 of the Periodic Table of Elements to said surface layer of the support; and
- (c) applying a compound of a third metal different from rhodium and from said second metal and selected from Groups 1 to 15 of the Periodic Table of Elements to the support.

37. The method of claim 36 wherein said third metal compound is applied to the support before either the rhodium compound or the second metal compound.

38. The method of claim 36 wherein the second metal compound is applied to the support either concurrently with or before the rhodium compound.

39. The method of claim 36 wherein at least one of (a), (b) and (c) is effected by an impregnation, precipitation, slurry mixing or coating step.
40. The method of claim 36 wherein said second metal is selected from Group 13 of the Periodic Table of Elements.
41. The method of claim 36 wherein said second metal is indium.
42. The method of claim 36 wherein said third metal selected from Groups 8 to 10 of the Periodic Table of Elements.
43. The method of claim 36 wherein said third metal is selected from one or more of iron, ruthenium and cobalt.
44. The method of claim 36 and, after (a) and/or (b) and/or (c), calcining the support at a temperature of about 100°C to about 600°C.
45. The method of claim 36 and, after (a), (b) and (c), treating the calcined support in a reducing atmosphere at a temperature in excess of 200°C.
46. A process for selectively removing alkynes or diolefins from a feedstock also containing olefins, the process comprising contacting the feedstock with hydrogen in the presence of a catalyst composition made by the method of claim 36.
47. A process for selectively removing alkynes or diolefins from a feedstock also containing olefins, the process comprising contacting the feedstock with hydrogen in the presence of a catalyst composition as claimed in claim 1.
48. The process of claim 47 wherein the alkynes or diolefins have 2 to 4 carbon atoms and the feedstock also contains C<sub>2</sub> to C<sub>4</sub> olefins.

49. The process of claim 47 wherein said contacting is conducted at a temperature of from about 20°C to about 150°C, a pressure of from about 690 kPa to 4100 kPa, and a molar ratio of hydrogen to alkynes and diolefins of from about 1 to about 1000.

50. The process of claim 47 wherein said contacting is conducted at a temperature of from about 30°C to about 100°C, a pressure of from about 1400 kPa to 3400 kPa, and a molar ratio of hydrogen to alkynes and diolefins of from about 1.1 to about 800.